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INSTITUTE OF GAS TECHNOLOGY

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CHICAGO 16, ILLINOIS

GAS ABSTRACTS

VOLUME 8, NUMBER 8

AUGUST, 1952

AFFILIATED WITH

ILLINOIS INSTITUTE OF TECHNOLOGY

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GAS ABSTRACTS is published and distributed monthly by the Institute of Gas Technology, Chicago 16, Illinois. The contents of selected papers and patents are reviewed impartially by the editorial staff and material of potential interest to the Gas Industry is presented. Subscription rates to non-members of the Institute: $15.00 per year.—Printed in the U.S.A.

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A special microfilm edition of Gas Abstracts can be supplied by University Microfilms, 313 N. First St., Ann Arbor, Michigan.

1. GAS INDUSTRY

Fuel Markets

Richmond, K. C. HEATING AND FUEL MARKETS: LAUNDRIES. *Coal-Heat*, **62**, 16-21 (1952) June.

Data from four separate surveys of the laundry industry are discussed. Of the 167 (50-67%) laundries in Chicago, 32% use oil or gas fuel. In Illinois, Indiana and Wisconsin, outside of Chicago 17% of 182 plants studied were fired by oil or gas. An American Institute of Laundering survey of 944 plants has data on costs but not of fuel. Of the 7500 U.S. commercial or power laundries it is estimated that half of these use coal, the typical plant averages 200 bhp., and at 5 tons coal/yr/bhp., this would require 3,750,000 tons of coal. O. P. Brysch

Gas Rate Increases

Burke, D. T. "WASHINGTON PIPELINE." *Gas Heat* **3**, 8 (1952) June.

FPC is considerably behind in handling applications for rate increases. Their usual procedure is reviewed. When a pipeline company serving several large systems applies for an increase a large number of cities are affected. J. D. Parent

WISCONSIN PUBLIC SERVICE COMMISSION, CITY OF MILWAUKEE V. MILWAUKEE GAS LIGHT COMPANY. *Public Utilities Fortnightly*, **49**, 133 (1952) May 8.

An investigation by the Wisconsin Public Service Commission at the request of the City of Milwaukee into the reasonableness of natural gas rates is reviewed. J. D. Parent

Gas Supply

Rose, W. THE GULF COAST TODAY: IT HAS THIRD OF NATION'S GAS; EXPANDING TRANSMISSION FACILITIES. *Oil Gas J.* **51**, 196-198 (1952) June 16.

This is a review article covering a number of topics such as flare gas, pipeline expansion and production figures with references to *Oil and Gas Journal* articles on these subjects. J. D. Parent

Merriam, J. F. NATURAL GAS SUPPLY: AN ANALYSIS OF SIX GREAT MIDCONTINENT BASINS. *Gas Age*, **109**, 13-15, 63 (1952) May 22.

The character and productivity of the major basin areas in the U.S.A. and Canada are reviewed briefly. J. D. Parent

Production Research

Herzog, G. WHERE PRODUCING RESEARCH IS HEADED. *Petroleum Eng.*, **24**, B16-B18 (1952) June.

Interpretation of logs, condensate production, loss of circulation, special mud preparation and corrosion are major problems receiving attention of research workers. J. D. Parent

2. APPLIANCES

Ignition Equipment

APPLICATION OF AUTOMATIC IGNITION SYSTEMS TO COMMERCIAL GAS COOKING EQUIPMENT. Research Bulletin 65. Am. Gas Assoc. Committee on Industrial and Commercial Gas Research, Project IGR-60 (1952) June.

Experimental studies with twelve automatic ignition systems installed in six contemporary commercial appliances were made. Results of temperature checks of pilot burner heads and orifices were given. The operation of the systems was satisfactory as long as no deviations from the manufacturers recommendation were made. D. L. Nicol

Long, H. J. SAFETY CONTROL APPARATUS FOR GASEOUS FUEL BURNERS. U.S. 2,600,252 (1952) June 10.

This patent is for a safety control for gaseous fuel burners. When the main valve is opened it allows gas to flow to pilot, gas to flow to the closed solenoid valve ahead of the main burner, and makes electrical contact energizing the electric pilot-ignition system. After the pilot lights, it heats a bi-metallic strip, breaking the electric pilot-ignition circuit and making the circuit which energizes the solenoid, opening this valve and allowing the main burner to light off of the pilot. B. G. Lang

Range Approval

McPherson, H. L. NEW DOMESTIC GAS RANGE REQUIREMENTS APPROVED. *Gas* 28, 47-48 (1952) June.

New requirements were approved for recessed range sections, double coaxial orifices, top burner valves, automatic ignition and thermostats for baking ovens. D. L. Nicol

Water Heaters

A STUDY OF TABLE-TOP WATER HEATERS. Research Report No. 1186-A. Am. Gas Assoc. Committee on Domestic Gas Research Project DA-1-WH (1952) June.

Due to the much smaller heat-transfer area for table-top water heaters as compared to conventional heaters of equal storage capacity, the gas input rate is limited to maintain normal thermal efficiency. Possible methods for overcoming the limitations without altering the external dimensions include: forced venting; multiple, inclined flue ways; combination internal and external flue construction; smaller combustion chambers; and instantaneous type heaters. The expedient of increasing recovery capacities by means of greater heat-transfer rates must be approached cautiously. Experience has demonstrated that as heat-transfer rate is increased the life of the water heater may be decreased. D. L. Nicol

Williams, D. D. COMMERCIAL WATER HEATERS. *Butane-Propane*, 14, 67-68 (1952) May.

The one type of gas usage that is more often overlooked for gas load is the commercial gas hot water heater. Sales points for this type of gas usage are given to show the dealer how to get this business. D. L. Nicol

3. COMBUSTION AND INDUSTRIAL FURNACES

Coal Gas Turbines

Bowen, I. G. GAS TURBINES. PART TWO (B). *Coke and Gas* (British). 14, 161-166 (1952) May.

This is the second of the series of articles on gas turbines and deals with fuels, particularly solid fuels and gases. Methods for handling and injecting pulverized coal for the gas turbine are discussed. In the United States where the most advanced work on coal burning has been done, the metal-lined combustion chambers have been found to operate satisfactorily. Refractory-lined combustion chambers of the slagging and non-slagging types are being investigated. The Westinghouse gas burning combustion chamber is discussed. A diffusion flame, which depends on simultaneous mixing of air and fuel is used. The gas is emitted from a number of orifices. Turbine choking and corrosion due to ash in the fuel is discussed, along with possible solutions to some of these problems. J. D. Parent

Yellott, J. I. and Broadley, P. R. TESTS OF A 4250-HP COAL-BURNING LOCOMOTIVE-TYPE GAS TURBINE. *Combustion*, 23, 65-67 (1952) May.

The coal-burning locomotive-type gas turbine unit which was designed for locomotive service was tested using coal following an initial series of tests using diesel oil. The unit operated for a total of 178 hours on coal after which the unit was dismantled for inspection. Examination of the turbine cylinder blading showed only one small spot of erosion with no deposite of ash anywhere in the turbine. A combustion efficiency of over 95 per cent is claimed for the unit. E. J. Pyrcioch

Hydrogen in Blast Furnaces

Boyle, J. L. HYDROGEN AS AN ADDITIONAL REDUCING AGENT TO COKE IN THE BLAST FURNACE. *Blast Furnace and Steel Plant*, 40, 535-537, May 1952.

The author suggests the use of hydrogen, alone or mixed as occurring in coke-oven gas, as an additional reducing agent to coke in the blast furnace. Advantages claimed are (1(hydrogen is a cheaper reducing agent than coke (2) tuyere-level temperatures would be increased (3) thermochemical requirements in hydrogen reduction of ore are more than halved. (4) steam-oxidation of iron and the water gas reactions would be repressed, making more carbon available (5) more ideal counter-current conditions would be attained with reducing agent in the blast moving past the descending ore. (6) sufficient coke oven gas is available on site in many

plants to give appreciable reduction (7) gas not consumed for reduction is still recoverable as a fuel. The importance of these advantages and the associated economics of such gas usage deserve some engineering study and experimentation. O. P. Brysch

Ink Drying

Easton, R. D. and Corkill, L. E. SPEED AND QUALITY OF NEWS PRESSES BOOSTED BY INSTANTANEOUS GAS DRYERS. *Am. Gas J.*, **176**, 22-23 (1952) May.

A major problem in production of high quality high-speed printing is the speed of drying of the inks. Improvements in inks had been restricted by the dual requirements of fast drying and ink plasticity. By the use of gas-fired ribbon burners with direct flame impingement, flash drying was attained eliminating even microscopic slurring of the ink impressions.

D. L. Nicol

Los Angeles Air

Magill, P. L. and Benoliel, R. W. AIR POLLUTION IN LOS ANGELES COUNTY. CONTRIBUTION OF COMBUSTION PRODUCTS. *Ind. Eng. Chem.*, **44**, 1347-1351 (1952) June.

In Los Angeles, Calif., the most disagreeable effects of smog are murkiness and irritation of the eyes, noses, and throats of the inhabitants. The most apparent economic effect is the damage to certain crops. Combustion products contribute materially to the atmospheric impurities. Approximately 50,000 tons per day of fuel and rubbish are burned in Los Angeles County. Public and industrial burning of these materials emits to the area each day at least 1800 tons of these impurities, not including carbon monoxide. Household burning of 4000 tons of trash, the biggest single source, sends 550 tons of organic materials into the air every 24 hours. Approximately two thirds of the chemicals entering the air from combustion are organic in nature. Exhaust fumes from approximately 2,000,000 automobiles, busses, and trucks in the county, which drive an average of 50,000,000 miles per day, contribute another 350 tons of organic substances as well as 30 tons of aldehydes and 40 tons of nitrogen oxides. Detailed data are presented showing the sources of the various impurities and the quantity each source emits. Authors' Abstract

Ore Reduction

Heath, T. D. (assigned to The Dorr Co.) PROCESS FOR REDUCTION OF IRON ORE TO MAGNETITE. U.S. 2,596,954 (1952) May 13.

Hematite iron ore is reduced to magnetite during its downward flow through three superimposed dense-fluidized beds which constitute preheating, gas combustion and reduction zones. The latter bottom zone is heated by partial combustion of hydrocarbon gases with oxygen at controlled rates to maintain reduction and fluidization. O. P. Brysch

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Mooi, J. CATALYTIC ACTIVITY OF SUPPORTED MANGANESE, COPPER AND IRON OXIDES. p. 158

Thomas, N. POLYMER FORMATION IN HYDROCARBON FLAMES. p. 158

4. CARBONIZATION AND GASIFICATION

Canadian Coke Ovens

Thomas, J. W. ONE MILLION TONS OF CARBON A YEAR. *Can. Chem. Processing*, **36**, 44-46 (1952) May.

The expanded coke-plant facilities of the Steel Company of Canada, Ltd., Hamilton, Ontario, are described. These include one battery of 83 and one of 47 Otto-Wilputte coke ovens, with new coal and coke handling, and byproduct equipment, which will increase the coking capacity by 1800 tons to 4800 tons wet coal/day. With blast-furnace gas underfiring, a surplus of 47 MMCF/day of 560 Btu gas is available (for Hamilton and Canada Works).

O. P. Brysch

Coal Gasification

Elliott, M. A., Perry, H., Jonakin, J., Corey, R. C., and Khullar, M. L. GASIFICATION OF PULVERIZED COAL WITH OXYGEN AND STEAM IN A VORTEX REACTOR. *Ind. Eng. Chem.*, 1074-1082 (1952) May.

The gasification of pulverized bituminous coal with steam and oxygen was studied in a continuous vortex chamber for producing synthesis gas.

Data are presented showing the effects of oxygen: coal ratio and chamber depth on carbon conversion and ratio of carbon monoxide-plus-hydrogen generated per lb. coal treated. Actual results obtained when operating at a typical oxygen-coal ratio of 8 cu. ft/lb. showed (a) carbon gasification of 73% (b) a $CO + H_2$ yield of 21 cu. ft/lb. coal and (c) requirements of 47.6 lb. coal and 381 cu.ft. oxygen/MCF of $CO + H_2$ generated. C. von Fredersdorff

Gumz, W. GASIFICATION OF SOLID FUELS AT ELEVATED PRESSURES. *Ind. Eng. Chem.*, **44**, 1071-1074 (1952) May.

Gasification of solid fuels under pressures of 20 to 30 atm. has become a proved technique which offers distinct advantages in high capacities, high fuel rates and low oxygen consumption. The production of synthesis gas from which a high-Btu fuel gas may be made are prospective applications of pressure gasification. A method is outlined with a number of references, for calculating gasification results from equilibrium constants and heat and material balances.
C. von Fredersdorff

Sebastian, J. J. POWDERED-COAL GASIFICATION: EFFECT OF VARIABLES. *Ind. Eng. Chem.*, **44**, 1175-1184 (1952) May.

The effects of operating variables on powdered coal gasification with steam and oxygen was studied in a vertical tube reactor of 6-in. diameter and 7-ft. length. To obtain a quality synthesis gas having CO_2 contents as low as 6 to 7%, it was necessary to pass from 40 to 50% excess carbon through the reactor. Typical reactant requirements per MCF of $CO + H_2$ were 47 lb. coal and 380 cu.ft. oxygen. Thermodynamic calculations based on test data were made to extend the interpretation of the effects of oxygen-coal ratio, steam-coal ratio and steam temperature beyond the range of variables studied. C. von Fredersdorff

Coal Structure

Howard, H. C. EVIDENCE FOR THE CYCLIC STRUCTURE OF BITUMINOUS COALS. *Ind. Eng. Chem.* **44**, 1083-1088 (1952) May.

The author cites deductions from ultimate analysis, thermal decomposition, solvent degradation, hydrogenation, and oxidation of coals. The nature of the degradation products indicates an original cyclic nucleus (C/H ratio of 1.00-1.15) rather than a linear (phenylene) structure, regardless of coal rank. O. P. Brysch

Coke Evaluation Tests

Campbell, R. W. A STUDY OF THE TESTS FOR THE EVALUATION OF COKE. *Blast Furn. and Steel Plant*, **40**, 643-650 (1952) June.

The work of the Joint Committee on Coke Evaluation of the American Iron and Steel Institute and the American Coke and Coal Chemicals Institute is discussed in considerable detail. Source of coals, types of blends used, and variation in oven dimensions are given for the 11 plants where tests were made. Sampling and tests are described, and the results of physical tests are interpreted in terms of correlation coefficients. The shatter test index is shown to be principally a measure of the size consist of the original sample rather than a measure of strength of coke. O. P. Brysch

Coking Tests

Mainz, H. DIE BACKFAEHIGKEITSBESTIMMUNGE UND IHRE PRAKTISCHE BEDEUTUNG (COKING CAPACITY TESTS AND THEIR PRACTICAL MEANING). *Brennstoff Chemie*, **33**, 124-129 (1952) April 23.

The author discusses laboratory coking-capacity tests, giving data on German coking coals and their mixtures with their own Fischer extracts (oily and solid bitumens). After discussing effects of oxidation and blending, he concludes that laboratory tests do not measure coking capacity, but its end-effect,—the agglutinating value for inert material. Resistance to breakage of pilot-oven coke appears to be a more reliable index for the plant operator.
O. P. Brysch

Electrical Precipitators

Francombe, K. W. ELECTRO-DETARRERS FOR COKE OVEN PLANTS. *Gas World* (British) **135**, (Coke Sect.) 53-57, 62 (1952) May 3.

The widespread use and general principles of electrical precipitators are reviewed, then a detailed description of design, operation and diagnosis of troubles of the Whessoe type of detarrer is given. O. P. Brysch

Fluidized Carbonizer

Odell, W. W. and Matheson, G. L. (assigned to Standard Oil Development Co.) CARBONIZATION OF CARBONIZABLE SOLIDS. U.S. 2,595,365; 2,595,366 (1952) May 6.

The first invention relates to a fluid bed carbonizing unit for treating pulverized carbonaceous material continuously to produce low volatile char residues. The unit is substantially divided into two sections; the upper section, operating at 900-1400° F., is fed with de-ashed carbonaceous solids and fluidized by air or combustion gas and steam plus recirculated gaseous products, while the lower section, operating between 1600-2000° F., receives the partially devolatilized material from the upper section and is fluidized by steam or air. The second invention relates to the removal of sulfur from the fluidized solid fuel by the above process using controlled injection of oxidizing gas. C. von Fredersdorff

Gas-Plant Wastes

Cunningworth, D. E. and Forlin, E. R. RIVER POLLUTION. *Gas World* (British), 135, 58-62 (Coke Sect.) (1952) May 3.

Chemical pollutants present in the effluents from coke-oven operation are discussed. Methods of analysis for these compounds and their treatment and disposal are described. Legal regulations concerning river pollution in England are discussed. C. E. Hummel

H_2S Removal

Ayers, G. W., Geerts, M. J., and Krewer, W. A. (assigned to The Pure Oil Co.) REMOVAL OF HYDROGEN SULFIDE AND MERCAPTANS FROM GASES OR LIQUIDS SUCH AS PETROLEUM OR PETROLEUM FRACTIONS. U.S. 2,592,523 (1952) April 15.

Various types of resins, modified by reaction with organic alkanolamines, react reversibly with hydrogen sulfide and mercaptans in gaseous or liquid hydrocarbon fractions. Regeneration of the modified resin is effected by washing with an alkali solution or by heating.

C. E. Hummel

Oil Gas Production

Hull, W. Q. and Kohloff, W. A. OIL GAS MANUFACTURE. *Ind. Eng. Chem.* 44, 936-948 (1952) May.

This article describes the methods used by the Portland Gas and Coke Co. to manufacture gas and by-products from oil. By-products data, cycle time, gas analysis and yields are given as well as descriptions of the facilities for gas and coke production. The company has been very active in by-products recovery, which yields a third of their total revenue. Among the products are oil-coke, tars, hard and soft pitch, creosote, naphthalene, refined light aromatics and lampblack. In the production of oil-coke the company attempts to segregate the higher carbon-content oils and blends these oils with lampblack and tar for the oil charge to the sole-flue ovens. A low ash-content coke is produced which finds a ready market in the regional aluminum industry. Another major by-product is lampblack, which under present operations averages 25 pounds per MCF and finds a market in the form of briquetted fuel or as carbon for chemical industries. A usual refining operation is used for liquid by-products recovery. High Btu oil gas production in 20-foot o.d. cross-connected generators is also described, and conclusions of interest to high Btu oil gas producers are listed.

L. N. Miller

Morgan, J. J. GASIFICATION OF HYDROCARBONS FOR PRODUCTION OF GASES TO SUPPLEMENT NATURAL GAS IN CITY SUPPLIES. *Gas Age*, 109, 45-50 (1952) June 5; 33-38 (1952) June 19.

Chapter II, Part 1, discusses the theoretical considerations and chemical reactions involved in the gasification of hydrocarbons by evaporation, pyrolysis and cracking. Chapter II, Part 2, deals with the catalytic cracking of hydrocarbons to produce carrier gases, the development of a high-Btu oil gas and the possibility of catalytic methanation of synthesis gas which would also be interchangeable with natural gas.

H. A. Dirksen

Organic S Removal

Griffith, R. H. CATALYTIC OXIDATION OF ORGANIC SULFUR COMPOUNDS IN COAL GAS. *Ind. Eng. Chem.*, 44, 1011-1014 (1952) May.

The organic sulfur compounds are oxidized by contact with a nickel subsulfide catalyst at 220-370° C. Thiophene is not decomposed by this process, but other sulfur compounds are reduced to about 2 grains per CCF. The decom-

posed organic sulfur appears as sulfur dioxide and hydrogen sulfide which are removed by a sodium carbonate wash and iron oxide, respectively. Periodic regeneration of the catalyst (which has a normal life of 3-4 months) is necessary. A 1.5 MMCF per day plant has been operating for 14 years, and details of a future installation of 15 MMCF per day capacity are presented. C. E. Hummel

Reformed Gas

Arnold, M. R., Atwood, K., Baugh, H. M., and Smyser, H. D. NICKEL CATALYSTS FOR HYDROCARBON-STEAM REACTION. *Ind. Eng. Chem.*, **44**, 999-1003 (1952) May.

Work carried on in semimicro reactors at high through-puts gave results that in general show the catalysts with higher nickel contents have higher activities. Promotion, porosity, surface area, pore size and particle size are to be studied to determine their effect on activity. H. A. Dirksen

McGurl, G. V. REFORMING NATURAL GAS AT THE ROCHESTER PLANT. *Gas*, **28**, 38-40 (1952) May.

Operating results for the Koppers-Hasche furnace installed at Rochester are given for natural gas feed. Data are reported for continuous operation as well as heat-run and make-run operation. H. R. Linden

Stark, V. NEW TYPE OF CATALYTIC GAS GENERATOR INCORPORATES ECONOMIC FEATURES. *Am. Gas J.*, **176**, 15-16 (1952) June.

A concentric catalytic generator is described and the advantages of lower temperature, longer contact time, higher efficiencies, reduced height, and cost are enumerated. H. A. Dirksen

Synthetic Ammonia

Cox, M. H. SINDRI INDIA'S 1,000-TON/DAY FERTILIZER FACTORY LAYS THE FOUNDATIONS OF HER HEAVY CHEMICAL INDUSTRY. *Chem. Process Eng.* (British), **33**, 247-253 (1952) May: *Canad. Chem. Processing*, **36**, 48-54 (1952) May.

The four main plants of the factory,—gas plant, ammonia synthesis plant, sulfate of ammonia plant and power plant—are described and illustrated. D. C. Gami

Water Gas Shift

Barkley, L. W., Corrigan, T. E., Wainwright, H. W., and Sands, A. E. CATALYTIC REVERSE SHIFT REACTION. *Ind. Eng. Chem.*, **44**, 1066-1071 (1952) May.

A study of the reverse water gas shift reaction showed the feasibility of adjusting gases containing excessive quantities of hydrogen to a lower H_2/CO ratio through catalysis of the reaction

$$CO_2 + H_2 = CO + H_2O$$

The reaction rates were determined graphically by taking slopes of a plot of conversion vs. reciprocal space velocity. Fitting the rate data to a series of four postulated mechanisms produced a plausible rate expression

$$r = \frac{k\left[P_{CO_2} \times P_{H_2} - \frac{P_{CO} \times P_{H_2O}}{K}\right]}{\left[1 + K_A P_{CO_2} + K_R P_{CO}\right]}$$

where K_A and K_R are adsorption equilibrium constants in reciprocal atmospheres for CO_2 and CO respectively, k is the reaction rate constant in lb.—moles CO_2 converted/hr./lb. catalyst/(atmosphere)^2 K is the thermodynamic equilibrium constant and r is the reaction rate in lb.—moles CO_2 converted 1 lb. catalyst/hr. The constants evaluated for 1000° F. are

$k = 0.595$, $K = 0.267$, $K_A = 4.46$, and $K_R = 41.65$

C. von Fredersdorff

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Arthur, J. R. MODE OF ENERGY RELEASE IN COMBUSTION OF CARBON. p. 157

Goring, G. E. KINETICS OF CARBON GASIFICATION BY STEAM. p. 159

Gulbranson, E. L. REACTIONS OF ARTIFICIAL GRAPHITE. p. 157, 158

President's Materials Resources Committee. RESOURCES FOR FREEDOM. p. 164

5. NATURAL GAS AND NATURAL GAS CONDENSATES

Carbon Black

Ekholm, W. C., and Heller, G. L. (assigned to Columbian Carbon Co.) MANUFACTURE OF CARBON BLACK. U.S. 2,597,232; 2,597,233; (1952) May 20: 2,599,981 (1952) June 10.

These patents relate to refinements in a method of making carbon black from natural gas enriched by oil. The gas is rapidly injected into and mixed with a turbulent body of hot-blast flame gas. J. D. Parent

Heller, G. L. (assigned to Columbian Carbon Co.) CARBON BLACK MANUFACTURE. U.S. 2,597,991; 2,597,992 (1952) May 27.

A process for making furnace blacks by partial combustion of hydrocarbons is claimed. Partial pyrolysis prior to contact with air is featured. In the second patent, a particular apparatus is claimed. J. D. Parent

Distribution Planning

Wilson, J. W. DISTRIBUTION PLANNING FOR SMALL UNDERTAKINGS. *Gas World* (British), 135, 471-476 (1952) May.

The problem of reorganizing distribution systems, particularly in small systems, should follow a planned program of distribution design. The system should be examined for its ability to meet (1) the present demands, (2) the demands of the immediate future, and (3) the demands expected sufficiently in the future to permit economical design. The method followed in analyzing a system having 1,574 consumers is described. B. E. Hunt

Drilling Practice

Robinson, R. L. MUD PRACTICES—IN THE DENVER-JULESBURG BASIN. *Petroleum Eng.*, 24, B54-B56 (1952) June.

The Denver-Julesburg basin is briefly described and drilling problems are reviewed. In some areas an emulsion containing 15 to 20% crude or diesel oil is used. This oil-base mud affords good lubrication for the tools and resists the unfavorable effect of high temperatures. Most wells are drilled to the Dakota Sands of the Lower Cretaceous Age. When drilling is carried below this into formations of the Permian Age, salt may be encountered. In this case saturated salt muds containing starch for good filtration properties are used. J. D. Parent

Gas Dehydration

Reid, L. S. ADVANCES IN GAS DEHYDRATION PROCESSES. *Petroleum Engr.*, 24, D42-D50 (1952) May.

Dehydration processes by glycol absorption, by adsorption with activated bauxite and alumina, by low-temperature separation and by glycol injection are discussed. It is concluded that glycol injections costs are greater, but these may be amply justified in many high-pressure applications. Adsorption is the most expensive of the four processes, but when properly designed and operated produces virtually "bone-dry" gas. D. C. Gami

Gas Handling

Stormont, D. H. PROGRESS IN STORAGE. *Oil Gas J.*, 51, 94-96 (1952) May 19.

Underground storage now represents a $170,000,000 investment. The number of projects grew during 1951 from 125 to 142. 4,384 wells and 96 compressor stations rated at 211,480 h.p. are involved. As of last October 31 the annual input was 337.7 billion cu ft while the output was 200.3 billion cu ft. Also mentioned is a report from Transcontinental Gas Pipe Line Corp. on the use of steam turbines as drives for centrifugal compressors. Results were most encouraging. Also encouraging was another report dealing with a gas turbine drive for centrifugal compressors. Some cost data are given. Testing of an orifice meter for a 30" line is included in the summary.

Abstractor's note: The title of this article is misleading as it is actually a set of abstracts of a number of papers presented at the recent Los Angeles meeting of the Natural Gas Department of the AGA. J. D. Parent

H_2S Removal

Jordan, J. T. (assigned to Shell Development Co.) METHOD OF ABSORBING GASES, INCLUDING HYDROGEN SULFIDE. U.S. 2,596,692 (1952) May 13.

Gas remaining after the recovery of gasoline constituents from the products of gas conden-

sate wells or crude oil wells is purified from hydrogen sulfide by countercurrent scrubbing with a lean absorption oil to reduce its sulfur content from 30-300 gr. of hydrogen sulfide to 5-20 gr. per Ccf. C. E. Hummel

LP-Gas Recovery

Carney, B. R. and Thompson, B. J. ECONOMICS OF NATURAL GAS AND LIQUEFIED PETROLEUM GASES. *Mech. Eng.*, 74, 467-472 (1952) June.

Even without change in natural gas processing, more LPG (6 to 8%) is becoming available annually. This presents marketing problems. Increased process efficiency could greatly augment the supply of propane since only about 40% propane and about 95% butanes are now recovered. Economic aspects of increased propane recovery and marketing are discussed in some detail in general terms. J. D. Parent

LP Underground Storage

Billue, H. G. HOW TO INSTALL AND OPERATE UNDERGROUND STORAGE FACILITIES. *Oil Gas J.*, 51, 218-221, 268 (1952) May 5.

Problems on locating suitable underground storage for LP-Gas and installing the necessary handling equipment are reviewed.

J. D. Parent

Loofbourow, R. L. EXCAVATING UNDERGROUND LP-G. STORAGE. *Oil Gas J.*, 51, 208-212 (1952) May 5. *Petroleum Engr.* 24, *Ref. Annual*, C48-C49 (1952) July.

Storage of LP-Gas in underground rock caverns is treated largely from the mining point of view. Factors of importance are reviewed. A cost of $2 to 8/bbl. of capacity in unlined rock is anticipated. J. D. Parent

New Pipelines

Hargrove, R. H. TEXAS EASTERN TRANSMISSION CORP'S. MAJOR EXPANSION PROGRAM NEARS COMPLETION. *Oil Gas J.*, 51, 126-130 (1952) May 12.

Texas Eastern Transmission Corp's. current expansion program is briefly outlined. This program includes construction of 791 miles of 30" new line, six compressor stations on the new line, the development of the Oakford storage field in conjunction with New York State Natural Gas Co. and the construction of six new compressor stations on the existing lines. System capacity will be increased to 1.2 billion cu. ft. per day. O. T. Bloomer

McGowen, N. C. THE STORY OF UNITED GAS PIPE LINE'S $181,000,000 EXPANSION. *Oil Gas J.*, 51, 111-113 (1952) May 12.

United Gas Pipe Line is now engaged in extensive additions to its system. The major portion involves laying of 1735 miles of pipe line, ranging from 6" to 30"; construction of the first large-diameter pipe line to tap gas reserves in the Gulf of Mexico off Louisiana; and addition of 64,000 h.p. in new and existing compressor stations. Total cost of this work is $181,000,000 and the capacity of the United Gas Pipe Line Co. system will be increased to nearly 4 billion CF/day. O. T. Bloomer

Nitrogen Removal

Mullins, P. V. (assigned to the United States of America) METHOD AND APPARATUS FOR TREATMENT OF GASEOUS HYDROCARBON MIXTURES. U.S. 2,595,284 (1952) May 6.

This invention relates to the separation of nitrogen from high-nitrogen natural gases by liquefaction and fractionation. J. D. Parent

Nelly, H. M., Jr. and Sullivan, T. E. (assigned to J. F. Pritchard & Co.) METHOD OF ENRICHING NATURAL GAS. U.S. 2,596,785 (1952) May 13.

This patent relates to a method of separating nitrogen from natural gas by absorption of methane and heavier constituents from the gas in a cold (-110° F) lean oil. This is followed by stripping of the lean oil so as to obtain a gas of controlled Btu content. Considerable savings in compressor horsepower is claimed because the rich oil containing methane and heavier constituents may be raised to transmission-line pressures by liquid pumps before being stripped of methane and thus eliminates the need of gas compression. Ethylene is used as the refrigeration medium. O. T. Bloomer

Odorization

Finke, H. L., Scott, D. W., Gross, M. E., Waddington, G., and Huffman, H. M. THE ENTROPY AND VAPOR PRESSURE OF 1-PENTANETHIOL. *J. Am. Chem. Soc.*, 74, 2804-2805 (1952) June 5.

Values were obtained for the low temperature

thermal properties and the vapor pressure of 1-pentanethiol (n-amyl mercaptan). The low temperature measurements cover the range of 12 to 320° K. and the vapor pressure was measured from 76 to 166° C. C. E. Hummel

Pipeline Inspection

Wunsch, W. and Brockhaus, S. Die Rohrkamera der Ruhrgas AG. (The Pipeline Camera of Ruhrgas AG) *Gas u Wasserfach* (German) **93**, *(Gas)* 117-121 (1952) May 1.

The development and operation of a camera inspection apparatus for photographing the interior of pipelines is given in detail. The camera and its light-supply are carried at the ends of two concentric sliding tubes, which are packed to avoid escape of gas from the attachment sleeve. This sleeve is flanged to bolt onto special inspection ports, normally closed by gate valves, which must be provided at selected points in the pipeline system. After the camera has been advanced the proper distance into the pipe, it and the lamp may be rotated independently, or slid by means of hand wheels, to take any number of photographs of a strip of the inner circumference. Special examples of colored and colored-stereoscopic photographs are given, to show the appearance of corroded, dusty and tarry surfaces. The apparatus is built by Technishe Werkstatten Dipl. Ing. Oswald Slickers, under Ruhrgas AG's German Patent No. 832,091 of Sept. 8, 1950 (to S. Brockhaus).

O. P. Brysch

Saturation Pressures

Organick, E. I. and Golding, B. H. PREDICTION OF SATURATION PRESSURES FOR CONDENSATE-GAS AND VOLATILE-OIL MIXTURES. *J. Petroleum Technology*, **4**, 135-148 (1952) May.

A simple correlation is presented for the prediction of saturation pressures in condensate-gas and volatile-oil mixtures. Saturation pressure is related directly to the composition of the mixture with the aid of two generalized composition characteristics, B, the molal average boiling point, and W_m, the modified weight average equivalent molecular weight. The need for hydrocarbon equilibrium constants is entirely eliminated. Only the values of the two composition parameters need be obtained, and these are calculated in a simple and reproducible manner from the stream analysis of the mixture and the ASTM distillation for the heavy ends. The correlation is given in the form of a set of 14 working charts in which saturation pressures, either retrograde dew-points or bubble points, are plotted vs temperature, forming partial phase envelopes for mixtures having discrete values of the composition parameters, B and W_m. A locus of critical states on each chart intersects the partial phase envelopes, distinguishing retrograde dew-point pressures from bubble pressures. A comparison between experimental and predicted saturation pressures reveals that: the probable error of the predicted values, when considering the data as a whole (214 experimental points), is five per cent; for high gas/oil ratio condensate fluids (approximately 40,000 or more cu ft/bbl) the probable error is about 8 per cent. In either case, however, the probable error is comparable with the overall uncertainty of the data from which the correlation is derived. Authors' Abstract

Underground Storage

Todd, R. W. OPERATION OF LA GOLETA GAS STORAGE FIELD. Paper to Natural Gas Department; Am. Gas Assoc., Los Angeles. May 12-13, 1952.

The La Goleta reservoir is an anticline, overlaid by impervious shales, blocked on one extreme by a fault system. Porosity of the tested sand cores averaged 26%. Permeability is quite variable, averaging 243 millidarcies. At the wells drilled the sand thickness varies from 32 feet to 377 feet, averaging 223 feet. Injection capacity is 90 MMcf/day, and withdrawal capacity is 350 MMcf/day; these figures will be increased. Storage capacity is about 14 billion cu. ft. of which about 10 billion can be withdrawn annually. J. D. Parent

Underwater Pipelines

Montfort, J. UNDERWATER PIPELINE IS REPAIRED AND RE-LAID. *Construction, Methods and Equipment*, **34**, 123, 126-131 (1952) April.

The article describes the equipment and methods used in raising, repairing, and re-laying a 20″ pipeline under the Mississippi River.

W. G. Bair

Reed, P. CROSSING THE NARROWS. *Oil Gas J.*, **51**, 89 (1952) May 19.

By a unique method known as submerged floatation, 6,600 ft. of 24-inch pipe was laid across the bottom of the New York Harbor Narrows between Staten Island and Brooklyn without interruption to the traffic. D. C. Gami

Well Control

Wharton, L. O. GAS VALVE ASSEMBLY FOR OIL WELLS. U.S. 2,595,824 (1952) May 6.

The invention relates to a valve mechanism for an oil well. Controlling the entry of gas within the well into the tubing for oil lift is the function covered. J. D. Parent

Well Treatment

Farris, R. F. and Clark, J. B. (assigned to Stanolind Oil and Gas Co.) TREATMENT OF WELLS; FRACTURING FORMATIONS IN WELLS. U.S. 2,596,843; 2,596,844; 2,596,845 (1952) May 13.

The present invention describes a method of increasing productivity of an oil or gas well by providing lateral drainage channels in selected formations adjacent to a well. Fractures in the formation are filled by injecting viscous oily liquid in the gel form, and subsequently shrinking and removing this gel to form permeable channels. Granular materials (sand, metal) may be introduced with the liquid to prop or space the fractured formation. D. C. Gami

Fast, C. R. (assigned to Stanolind Oil and Gas Co.) REMOVING DEPOSITS FROM WELLS. U.S. 2,596,137 (1952) May 13.

The patent claims to provide an improved solvent for oil and gas well deposits. To provide adequate time of contact an agent is added to give body and viscosity. Sufficient pressure to cause formation fracture is also claimed. Specific claims cover use of a mineral acid and a gum, particularly gum karaya. J. D. Parent

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Fauser, G. CHEMICAL UTILIZATION OF METHANE. p. 160

Neuhaus, M. PROGRESS IN PETROCHEMICALS. p. 160

6. PETROLEUM AND SYNTHETIC LIQUID FUELS

Ammonia and Methanol

Sherwood, P. W. PETROCHEMICALS FROM WATER GAS. PART II—DETAILS OF WATER GAS CONVERSION: THE AMMONIA AND METHANOL SYNTHESES. *Petroleum Eng.*, **24**, C21-C26 (1952) May.

Modifications of the conditions of the water gas reaction to give products suitable for ammonia and methanol syntheses are discussed. A comparison of existing processes for each synthesis is also included. C. A. Hall

Benzene from Petroleum

Williams, R., Jr. BENZENE FROM PETROLEUM—AT WHAT PRICE? *Chem. Eng.*, **59**, 157 (1952) May.

A price of $0.45 per gallon is estimated for benzene produced from a debutanized natural gasoline by the platforming process.

C. A. Hall

Communist Oil

Wzelaki, J. H. PETROLEUM FOR POWER IN RED EUROPE. *World Oil*, **134**, 252-256 (1952) May .

Present production of oil in the European communist countries exclusive of Soviet Russia is estimated to be 66,808,000 bbls. The Five Year Plan goal for these countries is set for 115,000,000 bbls. of which about 17.5 million bbls. will be synthetic production from coal. Best present opinion is that these production goals will be hard to meet. W. G. Bair

Desulfurization

DESULFURIZATION PROCESS: "AUTOFINING" DEVELOPED BY ANGLO-IRANIAN. *Petroleum Refiner.* **31**, 108, 109 (1952) June: *Petroleum Engr.* **24**, C31-C32 (1952) July.

A new catalytic desulfurization process, named "Autofining," has been developed by the Anglo-Iranian Oil Company. This process has been fully proved in extended operations in a 350 bbl./day pilot plant and the first commercial size unit of 3500 bbl./stream-day input capacity is

now in operation at the Anglo-Iranian Llandarcy refinery in South Wales. The Autofining process operates at pressures of 50-200 psig and at temperatures of 700°-800° F. and makes use of a very stable sulfur-resistant catalyst which has a long life. The catalyst is regenerated periodically, the on-stream period varying with the boiling range of the feed stock. A small amount of gas, consisting mainly of hydrogen, is produced in the process and this is recycled. No hydrogen manufacturing facilities are required. A wide variety of feed stocks can be effectively desulfurized, ranging from natural and straight run gasolines through naphthas and kerosenes to gas oils and light diesel fuels. Sulfur removed from the feed stocks is largely converted into hydrogen sulfide. The products are of good color and odor and are very stable. They need no subsequent refining treatment. The yields of liquid products obtained are 99 percent plus by weight or about 100 percent by volume.

Author's Abstract

Fischer-Tropsch Catalysts

Burton, W. P. (assigned to The M. W. Kellogg Co.) SYNTHESIS OF ORGANIC COMPOUNDS. U.S. 2,598,503 (1952) May 27.

Organic compounds are produced from a suitable mixture of hydrogen and carbon monoxide passed over an iron-alkali catalyst under appropriate conditions. W. J. Pleticka

McGrath, H. G. (assigned to The M. W. Kellogg Co.) HYDROGENATION OF CARBON MONOXIDE WITH PROMOTED IRON CATALYST. U.S. 2,598,647 (1952) May 27.

A system is claimed for producing oxygenated organic compounds from a suitable mixture of carbon monoxide and hydrogen, through a promoted iron catalyst with appropriate conditions.

W. J. Pleticka

Pyzel, R. (assigned to The M. W. Kellogg Co.) SYNTHESIS OF ORGANIC COMPOUNDS. U.S. 2,596,434 (1952) May 13.

A system for the hydrogenation of carbon monoxide with a fluidized hydrogenation catalyst is claimed, which uses a fraction of the vaporized organic compound to control the temperature of the reaction. W. J. Pleticka

Refining of Synthetics

Carlson, C. S., Catterall, W. E., and Staib, J. H. (assigned to Standard Oil Development Co.) TREATMENT OF OXO ALCOHOLS BY CAUSTIC AND AIR. U.S. 2,595,763 (1952) May 6.

Alcohols produced by the oxo-reaction followed by hydrogenation are purified by a combination air-caustic and distillation treatment.

C. A. Hall

McGrath, H. G. (assigned to The M. W. Kellogg Co.) SEPARATION OF ORGANIC COMPOUNDS. U.S. 2,596,160 (1952) May 13.

The products of the oxo-reaction followed by hydrogenation are separated by extraction and distillation operations. C. A. Hall

Shale Oil

Sherwood, P. W. SHALE OIL PRODUCTION AND REFINING TODAY. PART III. *Petroleum Refiner*, 31, 160-164 (1952) May.

The U.S. Bureau of Mines recently announced that it will build a much larger plant for the production and refining of shale oil. This project, together with the recent dangerous developments in Iran, has again placed the subject of shale oil in the limelight. The amount of crude oil available from U.S. shales is tremendous, and has been estimated in excess of 225 billion barrels. Beginning with Part I on the occurrence and nature of shale oil, the series outlined the various retorting processes for shale oil recovery in Part II. (*Gas Abstracts*, 8, 74; 98 (1952)). Part III discusses the refining operations for converting the recovered shale oil into gasoline or diesel oil. As the key to the entire future of the shale oil industry, the economic questions on gasoline production from shale oil are discussed. Author's Abstract

SCOTTISH SHALE OIL—A REVIEW OF AN IMPORTANT BRITISH INDUSTRY. *Petroleum* (British), 15, 158-160 (1952) June.

The distillation and refining of shale oil fractions are described starting from distillation of the crude to coke residue, yielding crude naphtha, a wax-free cut and a wax-bearing cut. Pressure distillation of the coke residue, and refining of the crude wax and naphtha complete the operations. A flow diagram is included.

C. von Fredersdorff

7. ANALYTICAL METHODS AND TESTS

Aromatic Spectra

Maddams, W. F. SYSTEMATIC SHIFTS IN THE ULTRA-VIOLET ABSORPTION SPECTRA OF POLYCYCLIC AROMATIC HYDROCARBONS. *Nature* (British) **169**, 743-744 (1952) May 17.

The systematic shifts in the ultra-violet absorption spectra of polycyclic aromatic hydrocarbons is considered from the viewpoint of changes in the electronic energy-levels of a regular sequence of these hydrocarbons. D. V. Kneibes

Gas Analyzer

Taylor, F., Jr. NEW COMBUSTIBLE GAS ANALYZER. *Instrumentation*, 5, 35-36 (1952) June.

This article describes the advantages of the new Davis combustible gas analyzer. These advantages are: increased stability and reduced zero drift, brought about by using thermocouples and a potentiometer circuit as contrasted to the conventional resistance measurement and bridge circuit. Thus the instrument can be used for remote head operation and for tube sampling systems. J. I. Wrozina

Gas Solubility

Baldwin, R. R. and Daniel, S. G. A METHOD FOR THE DETERMINATION OF THE SOLUBILITY OF GASES IN LIQUIDS WITH PARTICULAR REFERENCE TO VISCOUS LIQUIDS. *J. Applied Chem.* (British) **2**, 161-165 (1952) April.

A method for the determination of gas solubility is described which is claimed to be particularly suitable for use with viscous liquids.

D. M. Mason

Moisture Determination

Vincent, R. S. APPARATUS FOR THE DETERMINATION OF MOISTURE IN SAMPLES OF AIR. *J. Sci. Instruments*, 29, 155-157 (1952) May (British).

A sample of gas is taken into an evacuated flask which is subsequently connected to the measuring apparatus. The water vapor content is measured by the pressure difference created by absorption of the water vapor in phosphorus pentoxide. Before the determination the water is temporarily frozen on the inner surface of the flask, and the gas is purged out of the flask. The flask is subsequently warmed to revaporize the water. The method can be used over a considerable range of moisture contents by varying the size of the sampling flasks.

Abstractor's note: This method would seem to have considerable merit for the determination of moisture in small samples of gas (500 cc and under) when brought into the laboratory from the field. O. T. Bloomer

Nitrogen Determination

Alford, W. C. MICRODETERMINATION OF NITROGEN IN ORGANIC COMPOUNDS. *Anal. Chem.*, 24, 881-884 (1952) May.

Due to failures of Dumas and Kjeldahl methods for the determination of nitrogen, a new procedure has been developed. The combustion technique of the carbon-hydrogen train and the isolation of nitrogen according to the Dumas method have been combined to produce a method which has proved satisfactory for the analysis of virtually all classes of nitrogen compounds.

R. Parker

Spectrographic Analysis

Alexander, G. V. and Nusbaum, R. E. EMISSION SPECTROGRAPHIC ANALYSIS OF ORGANIC SOLIDS FOR INORGANIC CONSTITUENTS. *Anal. Chem.*, 24, 793-795 (1952) May.

A method for a spectographic analysis of organic solids for inorganic constituents is presented. To date, according to the authors, there has not been such a "method without a previous ashing". Apparatus, standards and a detailed procedure are described. It is is considered particularly successful and important for the analysis of mono-and polysaccharides. S. Sensi

Spectrometric Analysis

Broida, H. P. and Morgan, G. H. OPTICAL SPECTROPHOTOMETRIC ANALYSIS OF HYDROGEN-DEUTERIUM MIXTURES IN PRESENCE OF AIR. *Anal. Chem.*, 24, 799-804 (1952) May.

An electrodeless discharge at 150 megacycles in a continuous-flow gas system was used in conjunction with a high-resolution photoelectric grating monochromator to analyse gaseous mix-

tures of hydrogen, deuterium and air. The system and its calibration problems are described. A determination requires one minute and an accuracy of 0.1% of the mixture can be achieved.

D. V. Kniebes

Sands, J. D. and Turner, G. S. NEW DEVELOPMENT IN SOLID PHASE INFRARED SPECTROSCOPY. *Anal. Chem.*, **24**, 791-795 (1952) May.

A method of preparing solid samples for infrared spectrophotometric examination is described. Lamination and impregnation techniques have been devised using materials having transparent regions in the infrared such as mica, silver chloride, and polyethylene. A procedure for quantitative analysis utilizing this type of sample preparation is described.

D. V. Kniebes

8. GENERAL AND PHYSICAL CHEMISTRY

Carbon Oxidation

Arthur, J. R. and Bleach, J. A. MODE OF ENERGY RELEASE IN COMBUSTION OF CARBON. *Ind. Eng. Chem.* **44**, 1028-1034 (1952) May.

Experimental evidence tends to verify that the mechanism of carbon combustion takes place in two steps. First the carbon combines with oxygen to form carbon monoxide. This reaction is followed by the formation of carbon dioxide. The latter is in an excited state and upon returning to its ground state would release energy; thus it is believed that the blue glow that results from the combustion is due to the excited carbon dioxide molecule. Comparison of charcoal and graphite as the carbon source show that the former is controlled by diffusion at lower temperatures than the latter.

S. Mori

Gulbranson, E. A. REACTIONS OF ARTIFICIAL GRAPHITE (Mechanism Of The Oxidation Of Graphite At Temperatures Of 425 to 575° C.). *Ind. Eng. Chem.*, **44**, 1045-1047 (1952) May.

An absolute reaction rate theory was applied in the derivation of an equation for the carbon-oxygen system. This theory, postulated by Eyring and his co-workers, involves the calculation of the partition functions for the indicated species as the reaction complex goes from one region of configuration to another. A comparison of this rate with experimental data indicates that both the immobile adsorption and the mobile adsorption of the gas species on the active center (followed by dissociation) can be correlated.

S. Mori

Gulbranson, E. A. and Andrew, K. F. REACTIONS OF ARTIFICIAL GRAPHITE (Kinetics Of Oxidation Of Artificial Graphite At Temperatures Of 425°C To 575°C And Pressures Of 0.15 to 9.8 Cm. Of Mercury Of Oxygen). *Ind. Eng. Chem.*, **44**, 1034-1038 (1952) May.

The kinetics of the oxidation of a highly purified graphite are presented in this article. The initial rate of reaction obeys Arrhenius' Law, and has an energy activation of 30 Kgcal/per mole. The rate of carbon disappearance is a function of time, and its integrated form may be fitted into an equation $W = Kt + Ct^2$. The effect of pressure on the rate equation may also be expressed as $W = A + Bp$. Another influencing factor appears to be the method of pretreatment. This factor ties in well with the previous work on the conception of the formation of carbon-oxygen complex on the surface of the reactant as the primary step.

S. Mori

Gulbranson, E. A. and Andrew, K. F. REACTIONS OF ARTIFICIAL GRAPHITE (Surface Oxide Formation And Roughness Studies In Relation To Oxidation Of Artificial Graphite At Temperatures Of 25°C. And Between 425° and 575°C.). *Ind. Eng. Chem.*, **44**, 1039-1044 (1952) May.

Charcoal suspended in vacuum in a sensitive micro-balance was oxidized and evacuated under varying conditions to study the mechanism of oxidation on the carbon surface. The temperature ranged from 425° to 575°C. It was found that oxygen is not adsorbed instantaneously but the amount adsorbed was a linear function of time. The desorption of the surface oxide as a carbon compound presumably by breaking of two carbon bonds obeys Arrhenius' rate equation. Surface roughness may be increased with oxidation at these temperatures thus increasing the adsorption properties of the charcoal for oxygen.

S. Mori

Gulbranson, E. A. and Andrew, K. F. REACTIONS OF ARTIFICIAL GRAPHITE (Reaction Of Carbon Dioxide With Pure Artificial Graphite At Temperatures of 500° to 900°C.). *Ind. Eng. Chem.*, **44**, 1048-1051 (1952) May.
The kinetics of the carbon dioxide-graphite reaction has been studied from 500° to 700°C. at 7.6 cm. of Hg pressure. The results indicate that the formation of surface oxide on the graphite is only applicable below 800°C. Above this temperature no indication of the surface oxide as an intermediary step was obtained. Presence of reduced iron, and pretreatment with oxygen have a pronounced effect on the reaction rate.
S. Mori

Carbon Properties

Waelbroeck, F. ON THE MECHANISM OF EVAPORATION OF GRAPHITE. *J. Chem. Physics*, **20**, 757-758 (1952) April.
From the vapor pressure measurements on graphite between 2620-2840° K, in the Knudsen-cell, the sublimation energy of 141 kcal/mole was obtained. However the measured vapor pressure deviated from the equilibrium vapor pressure and was found to be a function of the aperture to total area ratio, and the sticking coefficient. The latter is a function of the electronic bonds holding the carbon together. For this reason, the sticking coefficient is influenced by both the double-bond C_2 and the single-bond C atom depending on where the carbon atom is being torn away. This had led to slight discrepancies in the results. S. Mori

Catalytic Oxidation

Mooi, J. and Selwood, P. W. STRUCTURE AND CATALYTIC ACTIVITY OF SUPPORTED MANGANESE, COPPER AND IRON OXIDES. *J. Am. Chem. Soc.*, **74**, 2461-2467 (1952) May 20.
A study of the mechanism of the catalytic oxidation of carbon monoxide in air was made using metallic oxides such as MnO_2, Fe_2O_3 and CuO dispersed on alumina. A maximum of carbon monoxide conversion was obtained at 1% concentrations for Fe_2O_3 and MnO_2 while 7% was required for CuO. The energy of activation also varied with various metallic oxides showing that the rate controlling mechanism may not be the oxidation of the carbon monoxide to carbon dioxide. S. Mori

Combustion Reactions

Thomas, N. POLYMER FORMATION IN HYDROCARBON FLAMES. *J. Chem. Physics*, **20**, 899-904 (1952) May.
A theory is developed to account for certain experimental phenomena occurring in hydrocarbon flames. It postulates the formation of highly unsaturated chain-polymers and their subsequent rapid breakdown to active fragments and oxidation of these. The theory is applied to a number of examples of experimental data on hydrocarbon flames. A mathematical discussion of the breakdown of chain-polymers by self-oscillation is given, using a classical model, and the relation between the theory and the experimental data is discussed with reference to earlier work on unimolecular decomposition.
Author's Abstract

Compressibility via Density

Silberberg, I. H. and McKetta, J. J., Jr. INVESTIGATIONS WITH GAS DENSITY BALANCE. PART I—THE PRINCIPLE AND THE METHODS OF USE. *Petroleum Eng.*, **24**, C5-C8. Silberberg, I. H., Kuo, P. K. and McKetta, J. J. Jr. PART II—COMPRESSIBILITY ISOTHERMS OF METHANE ETHANE, PROPANE, AND N-BUTANE AT LOW PRESSURES. *Petroleum Eng.*, **24**, C9-C20 (1952) May.
Contrary to popular opinion the gas density balance method may be used for precise research work. The compressibility factors of gases may be obtained directly. The molecular weight of gases may be obtained by indirect means. This paper covers three items: (a) the principle of the balance, (b) three methods of using the balance for experimental work, and (c) the use of air as a standard gas. Part 2 includes the experimental results on the low-pressure compressibility factors for methane, ethane, propane and n-butane. Authors' Abstract

Gas Solubility

Pray, H. A., Schweickert, C. E., and Minnich, B. H. SOLUBILITY OF HYDROGEN, OXYGEN, NITROGEN, AND HELIUM IN WATER AT ELEVATED TEMPERATURES. *Ind. Eng. Chem.*, **44**, 1146-1151 (1952) May.
Solubility data of oxygen, hydrogen, helium and nitrogen in water at temperatures from 125 to 650° F. and pressures up to 500 psia are pre-

sented. Within the experimental accuracy, the solubilities of these gases appear to be linear functions of pressures over the range investigated. D. C. Gami

Gasification Kinetics

Goring, G. E., Curran, G. P., Tarbox, R. P., and Gorin, E. KINETICS OF CARBON GASIFICATION BY STEAM. (Effect Of High Temperature Pretreatment On Reactivity Of Low Temperature Char to Steam And Carbon Dioxide.). *Ind. Eng. Chem.*, **44**, 1051-1056 (1952) May.

The integral rate of carbon gasification on a low temperature char, Disco, was found to be about twice that of the C-CO_2 system at 1600° F. This has been brought out by plotting the lb. atoms of carbon gasified per hr. per lb. atom of carbon, against carbon burnoff which may be expressed as the percent carbon gasified. Another variable, the pretreatment time with nitrogen at 1600° F., is an important variable which would influence the carbon gasification rate. The alternative cause for this effect has been postulated. S. Mori

Goring, G. E., Curran, G. P., Tarbox, R. P. and Gorin, E. KINETICS OF CARBON GASIFICATION BY STEAM. (Effect Of Pressure And Carbon Burnoff On Rate Of Interaction Of Low Temperature Char With Steam-Hydrogen Mixtures At 1600° F.) *Ind. Eng. Chem*, **44**, 1057-1065 (1952) May.

The differential rate of carbon gasification on low-temperature char, Disco, was also determined at zero bed-depth and 1600° F. This value is an extrapolated value from the integral rate obtained experimentally. The variables in this series of investigations are total pressure, fraction of original bed gasified, and H_2/H_2O rate. S. Mori

X-Ray Camera

Basinski, Z. S., Pearson, W. B., and Christian, J. W. FURNACE CONSTRUCTION AND THEROCOUPLE ARRANGEMENTS FOR A HIGH TEMPERATURE X-RAY CAMERA. *J. Sci. Instruments*, **29**, 154-155 (1952) May.

Modifications of a high-temperature X-ray camera and a new thermocouple design allow accurate specimen temperatures to be measured in the range 700-1000° C. Temperature gradients in the specimen are very small using the modified furnace. D. V. Kniebes

9. ORGANIC CHEMISTRY

Adduct Fractionation

Kobe, K. A. and Domask, W. G. EXTRACTIVE CRYSTALLIZATION — A NEW SEPARATION PROCESS. *Petroleum Refiner*, **31**, 151-157 (1952) May.

Part 2 of a three-part series discusses thermodynamic considerations applying to the process by which straight-chain organic compounds form adducts with crystalline urea.
D. M. Mason

Newey, H. A., Shokal, E. C. and Bradley, T. F. (assigned to Shell Development Co.) FRACTIONATION PROCESS. U.S. 2,596,344 (1952) May 13.

Vegetable oil acids or their derivatives may be fractionated according to degree of unsaturation by extractive crystallization with urea. Straight chain acids, or preferably their esters of the lower alcohols, form addition compounds with urea with increasing reluctance as their degree of unsaturation increases. The process generally consists of addition of urea, usually in aqueous solution, to a ketonic or alcoholic solution of the fatty acid or derivative, reacting at a temperature between 0° and 75° C., separating the raffinate from the urea solution and crystals of adduct, and heating the urea solution and crystalline adduct compounds to 80°-125° C. to decompose the adduct and thereby regenerate the urea and extracted fatty acid or derivative.
D. M. Mason

Ethylene Chemicals

Hogan, J. J. PETROCHEMICALS FROM ETHANE AND PROPANE. *Oil Gas J.*, **51**, 86-88 (1952) June 9.

The Mathieson Chemical Corp. plant at Doe Run, Ky., is very briefly described. This plant receives a combined liquefied petroleum gas, ethane, natural gasoline stream from the Tennessee Gas Transmission Co. plant at Gabe, Ky. (*Gas Abstracts*, 8, 5, 94) The principle product

is ethylene glycol; commercial quantities of ethylene oxide and ethylene dioxide are also produced. Liquefied petroleum gas and natural gasoline are also removed from the plant feed stream by fractionation. O. T. Bloomer

Methane Chemicals

Fauser, G. L'UTILIZZAZIONE CHIMICA DEL METANO. (Chemical Utilization of Methane) *Rivista dei Combustibili* (Italian), **6**, 63-83 (1952) February.

The utilization of methane for obtaining carbon black, for the synthesis of acetylene, hydrocyanic acid, halogenic compounds, etc. and for the production of synthesis gas for catalytic conversion with water or oxygen is considered. In view of Italy's large present and projected supply of methane, the possibilities of expansion of this branch of chemical industry are favorable. C. A. Hall

Jennings, R. J. ORGANIC CHEMICALS FROM NATURAL GAS—I. *Chem. Process Eng.*, **33**, 243-246 (1952) May.

In the U.S.A., where vast supplies of natural gas are obtainable, it is hoped to produce significant quantities of useful oxygenated materials from the partial combustion of its methane in the Hydrocol process. This is a modification of the successful German Sachsse process. This paper describes how the chemicals acetone, methanol, formaldehyde and acetaldehyde may be obtained on a commercial scale from natural gas. The following conclusions are reached: (1) The Sachsse, or controlled-oxidation, process is recommended for the ultimate manufacture of acetone, methanol, formaldehyde and acetaldehyde from natural gas. Where only formaldehyde is required (or, if it is not wished to produce formaldehyde from methanol) then partial-oxidation of methane under special conditions may be employed. (2) Acetylene-producing processes which yield large volumes of attendant hydrogen, in addition to acetylene for acetone and acetaldehyde manufacture, are unsuitable for methanol production. (3) When more high-quality methane becomes available from Britain's gas-rich coal seams, it may be worth erecting a small-scale plant near a colliery for the manufacture of the chemicals discussed. Author's Abstract

Neuhaus, M. and Sommer, N. B. PROGRESS IN PETROCHEMICALS. *Petroleum Processing*, **7**, 641-646 (1952) May.

A chart showing the chemicals derived from methane is given. Particularly significant among the recent developments in this field is a very great increase in the use of hydrogen made from natural gas for ammonia production. A similar increase in methanol production from natural gas is noted. C. A. Hall

Organic Sulfur

White, P. T., Barnard-Smith, D. G. and Fidler, F. A. VAPOR PRESSURE-TEMPERATURE RELATIONSHIPS OF SULFUR COMPOUNDS RELATED TO PETROLEUM. *Ind. Eng. Chem.*, **44**, 1430-1438 (1952) June.

The vapor pressure-temperature relationships of a large number of alkane sulfides, alkane disulfides, cyclic sulfides, and thiophenes are presented. Several correlations are included which relate the boiling points at 760 mm. and the B and C constants of the Antoine equation to the structure of the alkane sulfides and disulfides. The latent heats of vaporization which have been calculated from the vapor pressure measurements are tabulated with the critical constants of these sulfur compounds.
C. E. Hummel

Petroleum Aromatics

Dunn, C. L. and Liedholm, G. E. SHELL PROCESS PERMITS RECOVERY OF NITRATION-GRADE BENZENE AND TOLUENE. *Petroleum Refiner*, **31**, 104-108 (1952) May.

The Shell extraction distillation process has been successfully applied commercially to the production of nitration-grade benzene and toluene from petroleum sources. Stringent specifications must be met; for example, 0.1% of the next higher aromatic is alone sufficient to bring the distillation range to the ASTM specification limit. In order to meet all specifications and alow for variation in feed, composition and plant control, a plant must be designed for 99.5% purity. D. M. Mason

The following article, the abstract for which appears on the page indicated, is also called to your attention:
Finke, H. L. THE ENTROPY AND VAPOR PRESSURE OF 1-PENTANETHIOL. p. 152

10. CHEMICAL ENGINEERING

Dust Separators

Blomen, T. (assigned to Aktiebolaget Linderoths Patenter, Sweden) WET SEPARATOR FOR PURIFYING A PARTICLE LADEN GAS CURRENT. U.S. 2,598,032 (1952) May 27.

The patent claims a device for the purification of a particle-laden gas. The gas is admitted axially into a rotating drum, the louvered walls of the drum being wetted by a spray. Due to centrifugal action the gas passes through the wetted walls of the drum, leaving the housing through a tangential duct while the solid particles after passage through the walls are carried by the liquid to the bottom of the housing and discharged. E. J. Pyrcioch

Dalavalle, J. M. DRY DUST COLLECTORS FOR INDUSTRY. *Heating and Ventilating*, 49, 104-110 (1952) June.

The article discusses the inertial type of dust separator with emphasis on the cyclone. The cyclone is the most economical collector for the average installation and has highest efficiency at high dust loading in the inlet gases. Published data on inertial separation is scarce and more research is needed. W. G. Bair

Richardson, H. L. (assigned to Research Corp.) APPARATUS FOR AND METHOD OF HANDLING DUSTY MATERIALS. U.S. 2,596,601 (1952) May 13.

This patent applies to a method for handling dusty material wherein a layer of foam is utilized as a sealer for the receiving receptacle. It can be applied to use with cyclone separators and electrical precipitators. E. J. Pyrcioch

Fluidization

Toomey, R. D. and Johnstone, H. F. GASEOUS FLUIDIZATION OF SOLID PARTICLES. *Chem. Eng. Progress*, 48, 220-226 (1952) May.

A theory of fluidization is developed.

J. D. Parent

Fluid Pulverizer

Trost, C. and Holdcraft, J. W. (assigned to Freeport Sulphur Company) SOLID FEEDING MEANS FOR FLUID-TYPE PULVERIZER. U.S. 2,596,088 (1952) May 6.

A fluid-type pulverizer using a mechanical feeding device is described in this patent. Higher mill capacities are claimed over mills using injection feeding devices. E. J. Pyrcioch

Fluidized Reactor

Caldwell, C. L. (assigned to Houdry Process Corp.) METHOD AND APPARATUS FOR PROCESSES EMPLOYING FLUENT SOLIDS. U.S. 2,595,224 (1952) May 6.

A modification is made on the usual cylindrical catalyst reactor so that catalyst (3-to 8-mesh size) can be withdrawn from the center of the bed. Thus with a non-turbulent downflow process, two different catalyst-to-charging stock ratios can be achieved. This invention gives more adaptability in operation than conventional design. W. G. Bair

Fractional Permeation

Steiner, W. A. and Weller, S. W. APPARATUS FOR THE SEPARATION OF GASES BY FRACTIONAL PERMEATION THROUGH MEMBRANES. U.S. 2,597,907 (1952) May 27.

This invention relates to an apparatus for the separation of gas mixtures by the fractional permeation of gaseous mixtures through thin non-porous membranes. The apparatus provides for large areas of membrane disposed in compact units of minimum volume, and provides a simple means for supporting the low-pressure sides of the membrane in order that they might be able to withstand relatively large pressures without danger of rupture. O. T. Bloomer

Transfer in Packed Beds

Ranz, W. E. FRICTION AND TRANSFER COEFFICIENTS FOR SINGLE PARTICLES AND PACKED BEDS. *Chem. Eng. Progress*, 48, 247-253 (1952) May.

A method of analysis based on properties of a single particle is developed for estimating and characterizing transfer rates and pressure drops in packed beds. Transfer rates and friction factors for spheres are related through the application of a simple model to heat- and mass-transfer rates and pressure drops in beds packed with spherical particles. Equations for esti-

mating effective thermal conductivity and diffusivity are derived, and parametric constants relating the actual fluid velocity and the average lateral velocity to the superficial velocity, are shown to characterize the performance of a packed bed. This method of analysis reveals the mechanisms by which energy is lost and transfer occurs, and appears to have application to the design and evaluation of any transfer device which is an assemblage of a large number of simply shaped interfaces arranged in an ordered or random pattern.

Author's Abstract

Water Supply

Cooper, A. M. A SOLUTION TO OUR WATER SHORTAGE PROBLEM. *Public Utilities Fortnightly*, 49, 607-610 (1952) May 8.

Recent researches have resulted in a new, low cost ionic exchange method of de-salting sea water and rendering it useful for irrigation and city supplies. The cost of the new method has been estimated at 6¢/1000 gal. which will probably make the total delivered cost of the treated water 10¢ to 20¢/1000 gal. Coastal areas may turn to this method as the water shortage grows more acute.

W. G. Bair

11. PROCESS EQUIPMENT AND INSTRUMENTATION

Blower Pulsation

Acheson, O. W. PULSATION IN CENTRIFUGAL BLOWERS. *Gas Heat*, 3, 23, 44 (1952) June.

Pulsation can be obtained with centrifugal blowers when operating at low output. The effect depends on the characteristic pressure-volume performance curve of the blower and on the design of the piping system. An analysis of the problem is presented and remedies are suggested.

J. D. Parent

Gas Load Control

Cameron, W. C. HOW TO CONTROL AND MEASURE A WIDELY FLUCTUATING INDUSTRIAL PROCESS GAS LOAD. *Oil Gas J.*, 51, 156-158, 161 (1952) May 12.

The design considerations, instrument requirements, and instrument operation in a station built to control and measure widely fluctuating gas loads are discussed.

B. E. Hunt

Humidity Control

Wexler, A. and Daniels, R. D., Jr. PRESSURE-HUMIDITY APPARATUS. *J. Res. Nat. Bur. Standards*, 48, 269-274 (1952) April.

An apparatus for producing atmospheres of known relative humidity, based on the "two-pressure principle", is described. It has a working space (test chamber) of 1 cu. ft., in which the relative humidity may be varied and controlled from 10 to 98%, the temperature from −40° to +40° C., the air flow up to 150 liters/min., and the test-chamber pressure from ½ to 2 atmospheres. The humidity in the test chamber may be set and maintained to an accuracy of at least ½ of 1% relative humidity.

Authors' Abstract

Infrared Spectrometer

Goulden, J. D. and Randall, S. S. A SIMPLE ROTATING-CELL DOUBLE-BEAM UNIT FOR SPECTROMETERS. *Nature* (British), 169, 748-749 (1952) May 17.

The conversion of a single-beam infrared spectrometer to a double-beam operation by means of a simple rotating cell attachment is described.

D. V. Kniebes

Metering Economics

Bachmann, G. K. WHY CURRENT STUDIES MUST BE MADE OF ECONOMICS OF METERING. *Gas Age*, 109, 51-54 (1952) June 5.

A continuing study of the economics of metering must be made in order to prevent the loss of revenue by inaccuracies and meter obsolescence. Some of the factors contributing to such an economic study are discussed.

B. E. Hunt

Oxygen Handling

Peff, P. APPARATUS AND METHOD FOR TRANSPORTING AND DISPENSING LIQUEFIED GAS. U.S. 2,593,916 (1952) April 22.

This invention relates to an apparatus for transporting, storing and dispensing liquefied gas, such as oxygen. Means are provided for controlling the pressure developed in the tank during storage and when the contents are being dispensed.

O. T. Bloomer

Thermocouple Calibration

Quigley, H. C. RESUME OF THERMOCOUPLE CHECKING PROCEDURES. *Instruments*, 25, 616-622 (1952) May.

For ordinary work, the thermocouples fabricated by recognized manufacturers need no further calibration; however, under some conditions the thermocouples deteriorate and the calibration may change appreciably, so that a recalibration process is required. Two methods most widely used are the comparison of a known standard thermocouple against the questionable thermocouple at various temperatures, and the fixed point calibration where the questionable thermocouple is immersed in a pure component at its M.P., B.P., or F.P. These two methods are discused in detail in this article. S. Mori

Valves

Beard, C. S. VALVE POSITIONERS. PART II. DESIGN AND OPERATION. *Gas*, 28, 130-147 (1952) May.

Two basic types and other designs of valve positioners are described. Included is a drawing and discussion of each type showing in detail its operation. B. G. Lang

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Basinski, Z. S. FURNACE CONSTRUCTION FOR HIGH TEMPERATURE X-RAY CAMERA. p. 159

Taylor, F., Jr. NEW COMBUSTIBLE GAS ANALYZER. p. 156

Wunsch, W. THE PIPELINE CAMERA OF RUHRGAS A.G. p. 153

12. MATERIALS OF CONSTRUCTION

Carbon Pipe

Sherwood, P. W. CARBON PIPE COMES OF AGE. *Can. Chem. Processing*, 36, 86-88 (1952) May.

Some of the advantages of carbon pipe are discussed. A new pipe formed by coking bituminous coal with a swelling inhibitor is described. B. E. Hunt

Corrosion

Hendrickson, D. INTERCONNECTION OF PIPE LINES HAVING VARIOUS COATINGS. *Corrosion*, 8, 212-216 (1952) June.

The interconnection of aqueducts having dissimilar coatings, concrete and bituminous material, creates galvanic currents. The concrete coating is first destroyed, then the exposed metal. Long line currents generated can also cause the destruction of concrete coatings. B. E. Hunt

Kulman, F. E. LOCATION OF CORROSIVE AREAS. *Gas*, 28, 44-46 (1952) June.

This two part article gives the findings of five co-operating utilities to safeguard mains from corrosion. Studies of locating corrosive areas, bare pipe vs coated pipe, comparison of three coatings, scheme of cathode protection with magnesium anodes, and tests for electrolysis during construction of new mains are discussed. B. G. Lang

Spencer, K. A. CATHODIC PROTECTION OF BURIED PIPELINES. PART I AND II. *Petroleum*, 15, 121-123 (1952) May and 149-156, 160 (1952) June.

The first part of this article surveys the types of coatings presently used on pipelines and reviews the mechanism of corrosion and cathodic protection. Methods of making preliminary soil surveys are also discussed. In part two the types of surveys necessary before applying cathodic protection are described and the equipment required is reviewed. B. E. Hunt

Corrosion Inhibitors

Antinori, D. E. PROTECTION OF FERROUS SURFACES AGAINST CORROSION. *Gas Oil Power*, 47, 112-117 (1952) May.

Tests of various anodic and adsorption inhibitors to determine their protective qualities are discussed. B. E. Hunt

Moyer, M. I., and Hersh, J. M. (assigned to Cities Service Oil Co.) METHOD OF INHIBITING HYDROGEN SULFIDE CORROSION OF METALS. U.S. 2,596,273; 2,596,425 (1952) May 13.

The first patent describes the use of a mixture of 1 mole of, ethylene diamine plus 2 moles of formaldehyde as an inhibitor of the corrosion caused by H_2S in oil-well brine. The second

patent claims a similar inhibitor, specifically an equimolal mixture of mono ethanolamine and formaldehyde. B. E. Hunt

Non-ferrous Corrosion

Brown, M. H., Binger, W. W., and Brown, R. H. MERCURY AND ITS COMPOUNDS—A CORROSION HAZARD. *Corrosion*, 8, 155-164 (1952) May.

A type of corrosion in industry resulting in the failure of non-ferrous metals may be caused by either mercury or mercurous compounds. This type of corrosion takes place at the grain boundary interface and may be characterized by tiny longitudinal cracking of the metal. It is brought out that small quantities as low as 0.25 p.p.m. are adequate to start an attack on these nonferrous metals. S. Mori

Pipe-Coating Tests

Lee, C. E. NEW METHODS TO PREDICT SUITABILITY OF BITUMENS FOR PIPE COATING. *Gas Age*, 109, 24-26, 58, 59 (1952) April 24.

The "Blunt Rod" penetration test used by the Southern California Gas Co. to determine the acceptability of pipeline coatings is described in detail. A criticism of the ASTM penetration (D5-25) and softening point tests (D36-26) is made. Types of flow encountered in coating systems are discussed. B. E. Hunt

Pipe Salvage

Ledbetter, B. P. and Wilbanks, H., Jr. A TECHNIQUE FOR SALVAGING PIPE UNDER STREET CROSSINGS. *Corrosion*, 8, 185-187 (1952) May.

A method is described where by buried coated pipe is salvaged by carefully controlled heating to soften the coal-tar enamel coating and then pulling the pipe. B. E. Hunt

Welded Fittings

McLaughlin, C. B. and Tolliver, J. D. WROUGHT WELDED FITTINGS. *Gas*, 28, 91-93 (1952) June.

A discussion is given of various design considerations and application of wrought welding fittings for compressor stations, branch connections, and flanges. B. G. Lang

13. NEW BOOKS

National Resources

The President's Materials Policy Commission. RESOURCES FOR FREEDOM: VOL. I, FOUNDATIONS FOR GROWTH AND SECURITY (184 pp.): VOL. II, THE OUTLOOK FOR KEY COMMODITIES (210 pp.): VOL. III, THE OUTLOOK FOR ENERGY RESOURCES (43 pp.): VOL. IV, THE PROMISE OF TECHNOLOGY (228 pp.): VOL. V, SELECTED REPORTS TO THE COMMISSION, (154 pp.). Supt. of Documents, Washington, 25, D.C., June (1952).

This massive report is a "preliminary" review of the materials problem of the United States and its relation to the friendly nations, as compiled by Mr. W. S. Paley's staff of 120 specialists, aided by industry and Government consultants. Volume I presents a summary and analysis of the whole, emphasizing the growing inadequacy of our known materials resources to meet the projected demands and outlining the methods for ensuring a steady supply for the future. Chapters 16 to 22 (27 pages) summarize the energy problem, predicating an adequate supply upon full exploitation of the flexibility of the total energy complex by way of (1) consumers ability to choose fuel, (2) ready convertibility among forms of energy or fuel, and (3) ready transportation of energy. However, careful conservation of petroleum and natural gas, with increased research on shale, and on synthetic fuels from coal, are imperative to insure supplies, even before the end of the century. Projected energy demands in 1975 are tabulated in Volume II (p. 127-130), (with natural gas at 15 trillion cu.ft.) Volume III devotes 41 pages to a quite detailed treatment of the trends of oil, natural gas, coal and electric energy supply and demand. Volume IV devotes 4 chapters of 60 pages by industrial experts to coal products and chemicals, oil and gas as industrial raw materials, forecasts for petroleum chemicals, and possibilities of solar energy. The detailed data on projections for special chemicals, synthetic fuels, costs, and raw material requirements are of considerable interest because of their influence upon the gas industry. O. P. Brysch

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Analytica Chemica Acta
Analytical Chemistry
Applied Mechanics Review
Atomic Energy Newsletter
Australian Journal of Applied Science
Australian Journal of Scientific Research

Bibliography of Technical Reports
Bituminous Coal Research
Blast Furnace and Steel Plant
Brennstoff-Chemie
British Abstracts
British Coal Utilization Research Association Monthly Bulletin and Quarterly Gazette
Bulletin of the Atomic Scientists
Butane-Propane News

California Oil World
Canadian Chemical Processing
Canadian Gas Journal
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Gas Research Board Publications
Gas Times
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Independent Petroleum Association of America Monthly
Industrial and Engineering Chemistry
Industrial Finishing
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Industrial Heating
Institute of Fuel (British). Journal
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